Comprehensive Survey Report of the Recovery of the Fishery in Iola Millpond Following the 2011-2013 Drawdown (WBIC 278800) Waupaca County, WI

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2017

Executive Summary:

Iola Millpond is a 220 acre reservoir located in west central Waupaca County, Wisconsin. It is relatively shallow with a maximum depth of 9-10 feet, and nearly 63% of the lake area having a water depth of less than three feet. The millpond was drawn down 6-7 feet starting during the summer of 2011, and was finally brought back up again in spring 2013, resulting in the drawdown lasting nearly two years. The drawdown was proposed due to an overabundance of invasive aquatic plants including Eurasian water milfoil and curly leaf pondweed. The goal of the drawdown was to reduce nuisance aquatic vegetation by desiccation and freezing, compact accumulated sediments to increase water depth, flush sediments downstream out of the millpond, and allow for emergent vegetation to grow on the exposed sediment. Historical fish surveys have shown that the fish community of Iola Millpond was typical of that found in most other small impoundments in central Wisconsin. The gamefish population was comprised of a mix of largemouth bass and northern pike with a panfish population consisting of bluegill, black crappie, yellow perch, and pumpkinseed. Given the magnitude of the drawdown, the majority of the fish likely got flushed downstream as the water was drawn down. Beginning in 2013, a stocking effort was put in place to aid in the recovery of the fishery. Additionally, electrofishing surveys were conducted every year between 2013 and 2017 to monitor the recovery of the fishery. This report presents the results of an electrofishing survey conducted in 2003 (i.e., historical fish community prior to the drawdown) as well as the results from each year's electrofishing survey between 2013 to 2017 to show the recovery of the fishery following the refilling of the impoundment. By 2017, four years after Iola Millpond was drawn up, density and size structure of species that could be effectively sampled with electrofishing (i.e., largemouth bass, bluegill, and pumpkinseed) had returned to levels similar to, or above those observed prior to the drawdown. Results from this study show that a fishery can recover in as little as four years following a disturbance of the magnitude of a complete drawdown.

Introduction:

Iola Millpond is a 220 acre reservoir located in west central Waupaca County, Wisconsin. It is relatively shallow with a maximum depth of 9-10 feet, a mean depth of approximately four feet and nearly 63 percent of the lake surface area having a depth of three feet or less. The primary water source for Iola Millpond is the South Branch Little Wolf River, which flows into the impoundment in the northwest corner of the lake. Additionally, a second smaller unnamed headwater stream also flows into the impoundment in the northeast corner of the reservoir. A dam on the southwest corner of Iola Millpond controls water levels and also is the continuation of the South Branch Little Wolf River. Most of the shoreline around the southern half of Iola Millpond is developed, whereas most of the shoreline around the northern half remains forested. One public boat access can be found in Taylor Park on the southeast end of the millpond. Approximately 41% of the 160+ square mile watershed of the South Branch Little Wolf River is agricultural (WI DNR 2017). Given its shallow water and nutrient inputs from the watershed, Iola Millpond has a history of having dense aquatic vegetation that can limit recreational uses such as swimming, boating, and fishing.

Iola Millpond has been drawn down several times in the past 55 years to better manage the reservoir. The first drawdown occurred from 1965 through 1967 (Primsing 1985). The goal of this drawdown was to dredge out accumulating sediments, remove stumps that had been flooded when the reservoir was newly formed, and channelization (Primsing 1985). A second partial drawdown occurred during the winter of 1990-1991 with the goal of controlling the excessive aquatic plant growth in the reservoir (IPS Environmental and Analytical Services 1992; IPS Environmental and Analytical Services 1994). The third and most recent drawdown occurred between June, 2011 and May, 2013. During this drawdown, water levels were lowered 6-7 feet for nearly 2 years. This meant that the surface area of the reservoir decreased significantly with only the deepest parts of the reservoir (i.e., near the dam) maintaining reservoir like conditions and much of the upper portions being free flowing river channels.

The goal of the latest drawdown was to reduce nuisance aquatic vegetation (e.g., invasive Eurasian water milfoil and curly leaf pondweed) by desiccating and freezing sediments and seed banks, compact accumulated sediment to increase water depth, flush sediments and nutrients downstream out of the reservoir and encouraging the growth of emergent aquatic vegetation.

Iola Millpond has always supported, and continues to support a diverse mix of cool and warm water fish species. The top predators in the millpond are largemouth bass *(Micropterus salmoides)* and northern pike (*Esox lucius),* whereas the panfish community is dominated by bluegill (*Lepomis macrochirus),* black crappie (*Pomoxis nigromaculatus),* yellow perch (*Perca flavescens),* and pumpkinseed (*Lepomis gibbosus)*. Other fish species that have been captured in Iola Millpond include the lake chubsucker (*Erimyzon sucetta)*, which is a species of special concern in Wisconsin, golden shiner (*Notemigonus crysoleucas)*, white sucker (*Catostomus commersonii)*, yellow bullhead (*Ameiurus natalis)*, black bullhead (*Ameiurus melas)*, rock bass (*Ambloplites rupestris)*, and an occasional brown trout (*Salmo trutta)* may come down from the South Branch Little Wolf River.

As a public waterbody, the Wisconsin Department of Natural Resources (WDNR) has been managing the fishery in Iola Millpond for nearly 60 years. The WDNR conducted their first documented fisheries survey of Iola Millpond in 1960 (Wisconsin Conservation Department 1960). In his survey report, the biologist noted, “An excellent northern pike population with many 3-5 pound fish…and a very nice crappie population” (Wisconsin Conservation Department 1960). Fisheries surveys were also conducted in 1970, 1973, 1984, 2003, 2004, 2013, 2014, 2015, 2016, and 2017. Fyke nets, mini fyke nets, and electrofishing have all been used to assess the fishery in Iola Millpond over time. The WDNR has not had to stock many fish into Iola Millpond, indicating a healthy, self-sustaining fishery. Fish were only stocked into Iola Millpond following two of the three drawdowns. Largemouth bass, bluegill, and yellow perch were stocked between 1967 and 1970 following the first drawdown (Table 1; Primising

1985). Northern pike, largemouth bass, and bluegill were stocked between 2013 and 2016 following the latest drawdown (Table 1).

Prior to most recent drawdown, Iola Millpond supported a quality gamefish and panfish fishery dominated by the species described above. Given the magnitude and duration of the latest drawdown, it is likely that a significant amount of the fish were flushed downstream as the water was drawn down. In an attempt to recover the fishery as quickly as possible, the WDNR began stocking northern pike and largemouth bass in 2013, the first year the millpond was brought back up, stocked northern pike again in 2014 and largemouth bass in 2014 and 2015, and supplemented the bluegill fishery in 2016 with a stocking. Additionally, to monitor the progress of the recovery of the fishery, the WDNR has conducted an electrofishing survey every year since 2013. The objective of this report is to provide a summary of the recovery of the fishery following the latest drawdown by comparing the results of the last five years of electrofishing surveys (i.e., 2013 – 2017) to the results of the 2003 electrofishing survey, which was the last electrofishing survey conducted prior to the drawdown and will be considered the baseline for Iola Millpond. Furthermore, the results presented in this report can be used as a guide for other fisheries biologists throughout the state for what to expect for recovery times for their fishery if they propose a similar drawdown on an impoundment with a similar fish community.

Methods:

Field Sampling:

All electrofishing surveys were conducted using pulsed DC (direct current) electrofishing and survey crews consisted of one boat driver and two dip netters. Table two provides a summary of the electrofishing surveys conducted in each year including the date electrofishing occurred, the total miles shocked, miles shocked where only gamefish were collected, miles shocked where all fish were collected, and electrofishing boat settings including volts, amps, pulse rate, and duty cycle. The electrofishing surveys in 2003, 2013, and 2014 were all conducted during the fall (i.e., September 26 – October 8), whereas the 2015, 2016, and 2017 electrofishing surveys were all conducted during the spring (i.e., April 30 – May 18). Between 1.5 and 3.8 miles of shoreline were shocked during each year's survey. Electrofishing boat settings varied from 175 – 260 volts and 3 – 18 amps depending on what was most effective to sample fish on a given date. Pulse rate was set at 80 during the 2003 sample and was set at 50 for all other years. Duty cycle was set at 25 every year.

Two different station types are used during electrofishing surveys: 1.) a gamefish station in which only largemouth bass, northern pike, walleye, and muskellunge are netted and placed in a livewell for collection of scientific data; and 2.) a panfish/dip all station in which all fish that are encountered are netted and placed in a livewell for collection of scientific data (Simonson et al. 2008). Following completion of an individual station, all netted fish are identified, counted, and all gamefish and panfish are measured for total length. If a significant amount of panfish were netted during a single panfish/dip all station, three random scoops of panfish were collected from the livewell and all individuals captured in those three scoops were measured. The rest of the panfish that were captured during the station were identified and counted (Simonson et al. 2008).

A total of 3.8 miles of shoreline were electrofished on October 8, 2003. Water temps during the survey were 60 °F. Two different half mile stations were considered panfish/dip all stations, one along the south shoreline of Iola Millpond and the other along the northwest shoreline (Figure 1). Two different stations were gamefish only stations. The first, running along the west shoreline, was 1.5 miles long and the second, running along the east shoreline, was 1.3 miles long, for a total of 2.8 miles of gamefish only stations (Figure 1). A total of 2.5 miles of shoreline were electrofished on September 26, 2013. Water temperatures averaged 62.2 °F for this survey. The 2.5 miles of electrofishing were divided into five different half mile stations (Figure 2). Three of the half mile stations were panfish/dip all stations, one along the south shore, one along the northwest shore, and one along the northeast shore

(Figure 2). The remaining two half mile stations were gamefish only stations, one along the west shore and one along the east shore (Figure 2).

An additional half mile of electrofishing was added during the 2014 survey for a total of six different half mile stations (Figure 3). Electrofishing took place on September 29, 2014 and water temperatures averaged 61.7 °F for this survey. All six of the half miles stations were panfish/dip all stations (Figure 3). Electrofishing was moved from fall sampling to spring sampling in 2015 to be in line with the WDNR spring electrofishing II protocols. This sampling protocol is designed primarily to sample largemouth bass and panfish. A total of five different half mile stations were completed on April 30, 2015, resulting in 2.5 miles of electrofishing effort (Figure 4). Water temperatures averaged 62.7 for this survey. All five of the half mile stations were panfish/dip all stations (Figure 4). In 2016, sampling effort was again reduced down to three different half mile stations located along the western shore north from the dam (Figure 5). All three of the half mile stations were panfish/dip all stations (Figure 5). Sampling in 2016 was conducted on May 18 when water temperatures average 64 °F. The three stations that were sampled in 2016 were again sampled in 2017 on May 16 (Figure 6). Water temperatures averaged 69.3 degrees for the 2017 survey and all three stations were again classified as panfish/dip all stations (Figure 6).

Data Analysis:

Despite the fact that electrofishing is most effective at sampling largemouth bass, bluegill, and pumpkinseed, metrics were calculated for all gamefish and panfish species that are of interest to the public because a fyke netting survey (i.e., the gear most effective for sampling northern pike) has not yet been conducted following the drawdown. The total number of all species captured in a given year as well as catch per unit effort (CPUE), mean, minimum, and maximum lengths, proportional stock density (PSD), and length frequency histograms were calculated/created for largemouth bass, northern pike, bluegill, pumpkinseed, black crappie, and yellow perch for each sampling year. Trends in all of these metrics were used to assess the recovery of the fishery in Iola Millpond following the drawdown from 2011-2013 by comparing metrics calculated from annual sampling between 2013-2017 to those observed before the drawdown in 2003.

Catch per unit effort refers to the number of a given species captured per unit distance or time. For electrofishing surveys, CPUE is typically quantified as the number of a given fish species captured per mile of shoreline sampled. Catch per unit effort is used as an index to represent relative abundance and can be used to show changes in population density through time. Catch per unit effort can also be calculated based on the number of a given species that is a specified length or larger that is captured per mile of shoreline sampled. Proportional stock density is an index used to describe the size structure of a given species. It is calculated by dividing the number of quality size and larger individuals captured by the number of stock size and larger individuals captured. Quality and stock lengths for all species were taken from Anderson and Neumann (1996). Proportional stock density values of 40-60 typically describe a balanced population, meaning a population can produce harvestable size fish every year (Swingle 1950). Therefore, balanced fisheries have a mix of both harvestable size fish as well as smaller fish that will grow to be a harvestable size in the next couple of years. Length frequency histograms are a graphical representation of the number or percentage of fish of a given species captured by size intervals. Given that effort (i.e., distance shocked) varied considerably among years, percentages will be used for length frequency histograms so as not to unintentionally show what appears to be a difference in density or catch. Half inch size intervals were used for all panfish length frequency histograms whereas one inch size intervals were used for all gamefish length frequency histograms.

Results:

Prior to the drawdown, Iola Millpond supported a high quality, healthy fishery. Many of the popular gamefish and panfish species were meeting department management objectives. Species captured during the electrofishing survey in 2003 include black crappie, bluegill, golden shiner, lake chubsucker, largemouth bass, northern pike, pumpkinseed, rockbass, yellow bullhead, and yellow perch (Table 3). Iola Millpond showed significant resilience to the major disturbance in that the only two species sampled in 2003 that were not captured in 2013, the first year that the impoundment was drawn up. These were rock bass and yellow bullhead (Table 3). Furthermore, common shiners were not captured in 2003, but were sampled in 2013 (Table3). The following paragraphs present the recovery of each individual gamefish and panfish species in relation to their abundance and size structure prior to the drawdown.

Largemouth Bass:

Prior to the drawdown, largemouth bass density was just under 22 largemouth bass per mile of electrofishing (Figure 7). Surprisingly, largemouth bass densities in 2013 were nearly as high as they were prior to the drawdown when 14.0 largemouth bass per mile were captured (Figure 7). By 2016 and 2017, 25.3 and 27.3 largemouth bass were captured per mile of electrofishing, respectively, indicating that within four years after the drawdown, largemouth bass had returned to the densities observed prior to the drawdown (Figure 7) Largemouth bass densities of 25.3 and 27.3 largemouth bass per mile of electrofishing are considered moderate densities in Wisconsin, falling into the 68^{th} and 69^{th} percentiles statewide according to spring electrofishing surveys.

Survey results indicated a balanced largemouth bass population 2003. The mean length of all largemouth bass captured in 2003 was 10.3 inches, with a range from 2.4-20.0 inches and a PSD of 56 (Table 3; Figure 8). Furthermore, several 2-3 inch largemouth bass, which were likely age-0 bass from that year, as well as individuals in every inch class between 6 and 18 inches were captured in 2003 (Figure 9). These results indicate a balanced largemouth bass fishery with consistent recruitment and decent growth. While largemouth bass densities in 2013 were nearly as high as they were before the drawdown in 2003, the size structure observed in 2013 was much different (Figure 9). In 2013, the mean length of largemouth bass sampled was 5.7 inches, approximately half of what was observed in 2003 (Table 3). Most of the largemouth bass captured in 2013 were 3-4 inches and all but three were less than 10 inches long (Figure 9).

Interestingly, some adults must have survived in the millpond during the drawdown or moved upstream during the drawdown and re-established in the millpond after it was brought back up because three largemouth bass > 15 inches were captured in 2013, the same year as the refill (Figure 9). Results from surveys in 2014 and 2015 showed that the largemouth bass population was still dominated by smaller individuals, likely from the 2013 and 2014 year classes (Figure 9). Largemouth bass PSD in 2015 was 8 indicating that 92% of the largemouth bass > 8 inches were < 12 inches in length (Figure 8). By 2016 and 2017, there was an even mix of larger and smaller largemouth bass in Iola Millpond and densities, PSDs, and length frequency histograms from these two years showed a population that was similar to the one in 2003 prior to the drawdown (Figure 7; Figure 8; Figure 9). Nearly every inch class between 2-20 inches had at least one individual captured in 2017 indicating consistent recruitment and reasonable growth in that individuals are readily growing to sizes desired by anglers (Figure 9).

Northern Pike:

All results presented within this report are based on electrofishing surveys only. Fyke netting is more effective, and is the preferred method for conducting surveys to assess northern pike populations. No fyke netting surveys have been conducted on Iola Millpond following the draw up in 2013. Therefore, we have not yet been able to adequately quantify the effects of the drawdown and subsequent recovery of the northern pike population. Nonetheless, useful information regarding the northern pike population can be taken from the electrofishing surveys. First, densities of northern pike increased quickly following the draw up. Catch per unit effort was near or above five northern pike per mile between 2014 and 2016 (Figure 7). This indicates a relatively high density of northern pike within a few years following the refill. Additionally, some northern pike survived in the millpond or migrated upstream during the drawdown and recolonized following the draw up. The two northern pike collected in 2013 were 18.9 and 21.9 inches with two northern pike between 26-30 inches captured in 2014 (Table 3; Figure 10). Sampling also provided some evidence of natural reproduction by northern pike. The last northern pike stocking event took place in 2014 (Table 1), whereas a 12.2 inch northern pike was captured in 2017 (Table 3; Figure 10). Although no calcified structures were collected for aging from the 12.2 inch northern pike collected in 2017, it is unlikely that this fish is from the 2014 stocking class given how small it was.

Bluegill:

Prior to the drawdown, bluegill relative abundance in Iola Millpond was found at moderate-high densities averaging 153 bluegill per mile of electrofishing (Figure 7). As expected, bluegill density decreased dramatically following the drawdown with bluegill CPUEs being <36 per mile of electrofishing between 2013 and spring 2015, the first two years following the refill (Figure 7). By 2016, bluegill densities showed a substantial increase with CPUE increasing to over 100 bluegill per mile of electrofishing (Figure 7). By 2017, bluegill densities were at nearly the same level as those observed before the drawdown with just under 140 bluegill per mile being captured in 2017 (Figure 7). This density is at approximately the 66th percentile for bluegill densities throughout the state of Wisconsin according to spring electrofishing survey results.

Prior to the drawdown, bluegill size structure in Iola Millpond was dominated by individuals < 6 inches with a mean size of 4.5 inches and a PSD of only 17 (Table 3; Figure 8). However, some larger individuals were captured averaging eight bluegill > 7 inches per mile of electrofishing in 2003. Eight bluegill > 7 inches per mile of electrofishing shows that Iola Millpond had the potential to grow large bluegill prior to the drawdown. In 2013, the year of the refill, bluegill size structure was dominated by 2-3.5 inch bluegill, most likely from the 2013 year class (Figure 11). However, some adult bluegill must have survived the drawdown, residing in the original river channel or by migrating upstream and recolonizing after the refill because five bluegill between 6.5 and 8.5 inches were captured in 2013, the year of the refill (Figure 11). Overall, the mean length of bluegill sampled in 2013 was 3.7 inches, nearly an inch smaller than what was observed in 2003 (Table 3).

Surveys between 2014 and 2016 showed that the bluegill population was dominated by the prevalence of young year classes, primarily individuals < 6 inches in length with PSDs of 44 or less in all three years (Figure 8; Figure 11). Despite strong year classes coming through in each year resulting in populations dominated by smaller individuals, bluegill between 6-9 inches were captured in every year between 2014 and 2016 (Figure 11). By 2017, the bluegill population was balanced with a PSD of 48 (Figure 8). Furthermore, bluegill from the 2013 and 2014 year classes had grown to fill in the size classes that anglers prefer (i.e., 7-9 inches), while consistent recruitment has resulted in smaller individuals ready to grow to harvestable sizes (Figure 11). Additionally, in 2017, Iola Millpond had a high density of large bluegill, averaging 23.3 bluegill > 7 inches and 9.3 bluegill > 8 inches per mile of electrofishing. These CPUEs rank in the 81st and 92nd percentiles for bluegill > 7 inches and > 8 inches, respectively, for spring electrofishing surveys throughout the state of Wisconsin.

Pumpkinseed:

Compared to bluegill, pumpkinseed density in 2003 was an order of magnitude lower, averaging only 15 pumpkinseed per mile of shoreline (Figure 7). Similar to bluegill, pumpkinseed density decreased following the drawdown with only two pumpkinseed being captured in 2013 (Table 3). Pumpkinseed density increased each year between 2014 and 2016, peaking in 2016 at a density of 66 per mile of shoreline (Figure 8). Sampling in 2017 showed that pumpkinseed densities had decreased to levels that were similar to those observed in 2003, with 23.3 pumpkinseed per mile being captured in the spring 2017 survey (Figure 8).

Pumpkinseed were not measured in 2003, so no information on pre-drawdown size structure is available (Figure 12). Like the other species described above, some adult pumpkinseed survived the drawdown in the water that was left in the impoundment or migrated upstream and returned shortly after the refill because the two pumpkinseed that were captured in 2013, the first year following the refill, were between 4.5 and 5.5 inches (Figure 12). As pumpkinseed density increased, so did PSD in every year between 2013 and 2016 from a low of 0 in 2013 to a high of 66 in 2016 (Figure 8). Increases in PSD were driven by year classes growing to sizes preferred by anglers each year.

Black Crappie:

Black crappie density was similar to pumpkinseed density in 2003, averaging 25 black crappie per mile of electrofishing (Figure 7). As was seen with the other panfish species following the drawdown, black crappie density declined in 2013 to just over 25% of what was observed in 2003, averaging 6.7 black crappie per mile of shoreline electrofished in 2013 (Figure 7). Interestingly, black crappie densities did not increase through time following the refill as the highest density observed post refilling was in 2013 (Figure 7). Density actually declined between 2013 and 2016, and then rebounded slightly in 2017 back to densities similar to those observed in 2013, the first-year Iola Millpond was drawn back up (Figure 7).

The black crappie population in 2003 was dominated by smaller individuals < 8 inches total length with a PSD of 0, and a strong 2003 year class, as 12 crappies < 3 inches were captured (Figure 8; Figure 13). Like the other panfish species, some adult black crappie survived the drawdown in the impoundment or migrated upstream during the drawdown and returned as soon as the impoundment was filled because black crappies between 6.5 and 12.5 inches were captured in 2013 (Figure 13). Black crappies likely pulled off year classes in 2013 and 2014 as crappies < 3 inches were captured in both of these years (Figure 13). Few total black crappies and no black crappies < 6.5 inches were captured in 2015 and 2016 (Figure 13). By 2017, most black crappies captured were between 4-6 inches in length, indicating a year class may be growing to harvestable size in the next couple of years (Figure 13).

Yellow Perch:

Yellow perch populations are difficult to sample with either fyke nets or electrofishing, making it difficult to assess trends in yellow perch populations using the two most common sampling gears employed by the WDNR. The trends observed in the yellow perch population were similar to those of the other panfish species. Density of yellow perch declined as a result of the drawdown. CPUE of yellow perch in 2013 was 13% of what was observed in 2003 (Figure 7). Yellow perch CPUE between 2014 – 2016 was less than what was observed in 2013 and was overall very low, averaging < 1 yellow perch per mile of electrofishing (Figure 7). Yellow perch CPUE showed a significant spike in 2017, jumping up to 10 per mile of electrofishing (Figure 7). This density was similar to what was observed prior to the drawdown in 2003 (Figure 7).

Some yellow perch survived in the impoundment during the drawdown or migrated upstream and returned following the refill because a 7.8 inch yellow perch was sampled in 2013 (Table 3; Figure 14). No yellow perch < 6 inches were captured between 2014 – 2016 which could indicate it took several years following the refill for yellow perch to pull off a strong year class (Figure 14). By 2017, the yellow perch population was dominated by individuals < 7 inches, likely indicating some successful yellow perch recruitment in the previous year or two (Table 3; Figure 14). Hopefully these year classes will reach harvestable size in the next year or two, providing a yellow perch fishery in Iola Millpond again.

Discussion:

Results from our surveys showed that within four years following Iola Millpond being drawn back up, the largemouth bass, bluegill, and pumpkinseed populations had recovered to levels that were similar to those observed prior to the drawdown. Relative abundances (i.e., CPUE) and size structures of these three species in 2017 were similar to those observed in 2003. Furthermore, relative abundances of largemouth bass, bluegill, and pumpkinseed in 2017 were in the 69th, 66th, and 81st percentiles, respectively, when compared to waterbodies throughout the state of Wisconsin. Therefore, densities of these three important fish species had returned to densities higher than at least 66% of the other lakes throughout the state within four years. Given the fact that electrofishing is not the preferred/most effective sampling gear to sample northern pike and yellow perch, conclusions will not be made regarding the recovery of these two species.

Black crappie relative abundance in 2017 was approximately 1/4 of what was observed prior to the drawdown in 2003. However, in 2017, black crappie CPUE was 6.0 black crappies per mile of electrofishing, which ranks in the 50^{th} percentile statewide, indicating that black crappie density in Iola Millpond had recovered to a level that is in the middle of what is observed for black crappie densities throughout the rest of the state of Wisconsin. The black crappie population in 2003 was dominated by two smaller year classes with no individuals greater than eight inches captured. Given that in some waters, crappies can show highly erratic recruitment (i.e., strong year classes followed by years of poor recruitment or recruitment failures; Hooe 1991; Guy and Willis 1995; Allen and Miranda 1998), the fact that two young year classes were observed in 2003 could explain the high density of black crappies observed that year. Furthermore, the possibility exists that the black crappies in Iola Millpond are showing erratic recruitment following the refill and that they have not been able to pull off strong year classes since the impoundment was refilled.

Surprisingly, as shown from the results of the fall 2013 survey, adults from all gamefish and panfish species survived the duration of the drawdown, a time period that included two winters, either in the limited water that was left in the reservoir or by migrating upstream during the drawdown and recolonizing the impoundment once it refilled. Survival of adults, even a few, within the impoundment or adjoining water bodies can shorten the recovery time of the fishery, especially for gamefish species. Most northern pike don't mature until they are two or three years old and largemouth bass may not mature until they are three or four years old (Becker 1983). Adults that can survive the drawdown can begin to reproduce the first year the impoundment is drawn back up. If adults are not able to survive in the impoundment throughout the drawdown and the population is started solely from stocked fish, it may take several years before any of the stocked northern pike or largemouth bass begin reproducing. A secondary benefit to having adults survive through the drawdown is that there will be quality fishing opportunities immediately following the refill, although they may be limited due to low numbers of fish.

Natural reproduction from adults that survive in the impoundment during the drawdown or migrate upstream and recolonize the impoundment after refilling could also limit the need for stocking. In the case of Iola Millpond, northern pike were only stocked in the first two years following the draw up and largemouth bass were only stocked during the first three years. Although the contributions of naturally reproduced versus stocked largemouth bass and northern pike to the fishery were not evaluated, it is likely that both sources contributed to the fishery for these two species. Furthermore, given that the density of largemouth bass in 2013 was nearly as high as it was before the drawdown, combined with the fact that most largemouth bass sampled in 2013 were < 5 inches, it is likely that stocking did contribute to this year class of largemouth bass. One reason it took a few years longer for the panfish population densities to reach pre-draw down levels is that the WI DNR does not raise panfish in their hatcheries; therefore, panfish could not be stocked to supplement natural reproduction as with the largemouth bass and northern pike.

Initially, growth of most fish species is likely to be fast following the refill. The primary reason for this is that fish densities will be low resulting in little competition among individuals for food or habitat resources. Evidence of fast growth can be seen from the length frequency histograms for largemouth bass. Although no calcified structures were taken to validate ages, you can readily follow the 2013 year class through time by looking at the length frequency histograms. The largemouth bass sampled in fall 2013 were dominated by individuals <5 inches that likely hatched in 2013. By the fall 2014/spring 2015, this year class had grown to 6-10 inches. By the spring of 2016, they had grown to 10-13 inches and by spring 2017, they had grown to 13-16 inches. Most individual largemouth had grown to 14-15 inches in four growing seasons, which is considered fast for Wisconsin as it takes six years on average for a bass in this state to reach 14 inches.

A second reason fish may grow faster following a drawdown is that drawdowns may temporarily reverse some of the effects of reservoir aging. Reservoirs are most productive within the first couple of years/decade following their creation (Kimmel and Groeger 1986). This is when a reservoir is its deepest and has lots of fish habitat as all of the terrestrial vegetation, trees, etc. are newly flooded. Through time, reservoirs fill in with sediments from deposition from the stream that creates the reservoir, and flooded terrestrial habitat (trees, etc.) decomposes, resulting in less productive conditions (Kimmel and Growger 1986). A drawdown, if done for a long enough period of time, could reverse some of the effects of reservoir aging by adding depth through flushing of sediment and compaction of existing sediments. Invasive plant species could be replaced by more desirable native plant species. Emergent aquatic, terrestrial grasses, and even some water loving woody plants such as willows could grow in areas that were exposed and then flood again once the impoundment is refilled. All of these things can result in more productive/healthier reservoirs.

The primary objective of the drawdown was to reduce the overabundance of invasive aquatic plants including Eurasian water milfoil and curly leaf pondweed. In order to ensure the fishery in Iola Millpond is maximized in the future, it is imperative that the benefits of the drawdown be sustained by minimizing the impacts of invasive aquatic plants. Research has shown that highly dense invasive aquatic plants can negatively impact the feeding of many fish species, especially visual predators such as northern pike and largemouth bass. For example, Savino and Stein (1982) found that largemouth bass were unable to capture bluegills in tanks with very high densities of artificial plant stems. Their observations were that high plant stem densities acted like visual barriers, preventing largemouth bass from seeing their bluegill prey (Savino and Stein 1982). If largemouth bass cannot effectively forage, their growth rates will decline. Additionally, predation by species such as largemouth bass is what prevents panfish populations from becoming overcrowded and expressing slow, density dependent growth.

Similarly, Wiley et al. (1984) conducted experiments in hatchery ponds to evaluate the effects of aquatic plant densities on largemouth bass production. Their results showed that when plant densities were too high, largemouth bass could not effectively see their prey (i.e., bluegill) and the high density of plants acted as a refugia for the prey fish (Wiley et al. 1984). In a study of the effects that removal of submersed aquatic plants in Wisconsin lakes with high densities of Eurasian water milfoil had on growth of bluegill and largemouth bass, Olson et al. (1998) observed increased growth rates in some age classes of bluegill and largemouth bass in lakes where milfoil was removed by cutting lanes compared to lakes that experienced no removal. Interestingly, not all age classes of bluegill and largemouth bass growth rates showed the same increased growth following aquatic plant removal (Olson et al. 1998).

Iola Millpond has a high-quality bluegill fishery with bluegill >8.4 inches captured in every sampling event and bluegill as large as 9.4 inches being captured. Bluegills are unique in that their social structure affects male spawning success. Bluegills build spawning nests in colonies and male bluegills will compete for the best spawning locations within the colony, often located in the center of the colony where they will have the lowest chance of predation (Gross and MacMillan 1981). Small bluegills that cannot effectively compete with larger males for the best nests will devote little energy towards reproduction until they grow to sizes where they can compete for the best nests (Jennings et al. 1997; Aday et al. 2006; Hoxmeier et al. 2009). When larger males are not present, smaller males will mature at a younger age and size and devote more resources to gonad development rather than growth (Jennings et al. 1997; Aday et al. 2003; Aday et al. 2006; Hoxmeier 2009). Therefore, the largest male bluegills in the population can drive the overall size structure of the bluegill population by dictating the size at maturation.

Bluegill angling is very popular throughout North America with anglers targeting the largest individuals in the population for harvest. Many studies have shown that angling and angler harvest can reduce the size structure of bluegill populations by removing the largest individuals (Goedde and Coble 1981; Coble 1988; Beard and Essington 2000). Given the social reproductive nature of bluegill described earlier, removal of larger males in the population through angling can results in males that mature at younger smaller sizes, and a population with smaller size structure as energy is devoted to reproduction rather than growth. Drake et al. (1997) observed that lakes that had low fishing effort contained older, larger males and that growth rates of older bluegill was faster in lakes with less fishing effort compared to those with high fishing effort. High angler exploitation resulted in lakes with younger, smaller bluegills maturing (Drake et al. 1997). Given that the ultimate goal of wild animals is to reproduce and pass their genes on to the next generation, the social aspect of bluegill reproduction in which males will only grow as large as is necessary to successfully reproduce means it will lengthen the amount of time it will take for the size structure of a bluegill population to recover if size structure is significantly reduced through angling (Beard and Essington 2000). If anglers are concerned that bluegill exploitation is getting high on Iola Millpond, they should explore the option of changing the panfish regulation to one that will reduce exploitation and protect some of the larger male bluegills in the population.

Interestingly, pumpkinseed population density increased more quickly than bluegills, peaking in 2016 followed by a decline in 2017 to densities similar to those observed in 2003. Bluegill density continued to increase in every year following the draw up. Resource partitioning and competition among the two similar species could explain the observed trends. Juveniles of both species forage primarily on soft-bodied macroinvertebrates and plankton within vegetation to avoid predators (Mittelbach 1984; Mittlebach 1988). Therefore, as juvenile bluegill density increases, a trend observed in Iola Millpond through time, the amount of resources available to juvenile pumpkinseed will decrease due to competition with bluegill for resources (Mittlebach 1988). Furthermore, adults of both species tend to feed differently in the presence of each other to prevent competition among adults. In the presence of bluegill, pumpkinseed adults will use their molariform teeth on their pharyngeal pads to feed primarily on snails and other gastropods with hard shells (Mittlebach 1984). Bluegill do not have molariform teeth and cannot crush snail and mollusk shells, and feed primarily on zooplankton and other soft-bodied macroinvertebrates that do not have hard shells (Mittlebach 1984). When bluegill are absent, adult pumpkinseed will feed on zooplankton, other soft-bodied invertebrates, and snails, meaning a lot more resources are available to them (Osenberg et al. 1992). Therefore, adult population densities for bluegill and pumpkinseed are going to be driven by soft-bodied macroinvertebrate/zooplankton density and snail density respectively (Mittlebach 1984). Other research has shown that when both species are present, lakes that have high number of zooplankton/soft-bodied macroinvertebrates and low snail density have a high ratio of bluegill to pumpkinseeds whereas lakes with a low number of zooplankton/soft-bodied macroinvertebrates and high snail density show the opposite trend (Mittlebach 1984).

Summary and Management Recommendations:

By spring 2017, four years after Iola Millpond was drawn back up, the fishery could be considered recovered. Results from department electrofishing surveys conducted every year since Iola Millpond was refilled show that the density and size structure of largemouth bass and panfish populations in 2017 were similar to those observed prior to the drawdown and are also similar to those observed in lakes throughout the state. Overall, Iola Millpond has what would be considered a high-quality fishery. Therefore, it is no longer necessary to sample it on an annual basis. The millpond is scheduled for a comprehensive fisheries survey, including a fyke netting survey and electrofishing survey, in the spring of 2020. This comprehensive survey will allow us to again monitor the progression of the fishery following refilling. Furthermore, the netting survey will give us the opportunity to evaluate the northern pike fishery in Iola Millpond since electrofishing is not the preferred method to sample northern pike and the conclusions we can draw regarding this species from the electrofishing survey results are limited.

Iola Millpond has a high-quality bluegill fishery with the potential to grow bluegills greater than 9-10 inches. High levels of angler exploitation can remove the largest bluegill from the population. Given their social reproductive strategy, removal of the largest male bluegills can result in other male bluegills maturing at younger, smaller size, potentially resulting in a bluegill fishery with a reduced size structure. If anglers are concerned that overexploitation may occur in the bluegill fishery, a special regulation such as a reduced bag limit should be considered. Additionally, the lake district should continue to work with the WDNR to manage aquatic plants in the future. Furthermore, efforts should be made to limit prevalence of invasive species such as Eurasian water milfoil and curly leafed pondweed. A diverse mix of native plants provides much better habitat for fish than a monoculture of highly dense invasive plants. By providing habitat that gives predators opportunities to forage effectively, largemouth bass and northern pike growth rates will be enhanced while at the same time preventing bluegill and other panfish from becoming over abundant and experiencing reduced growth rates due to density dependent competition for food resources.

One avenue that local landowners or the lake district could pursue to enhance fish habitat would be to complete fish sticks projects by adding trees to the near-shore, littoral zones of a millpond. While much of the southern half of Iola Millpond is developed, much of the northern half remains forested, although it is privately owned. Prior to the drawdown, much of the upper portion of Iola Millpond was extremely shallow and the sediment mostly silt, providing little value as fish habitat. As a result of the drawdown, some areas in the northern portions of Iola Millpond had deeper riverine channels scoured out and sandy/rocky substrate is now exposed. Increases in depth combined with harder substrate make the northern portions of the lake ideal spawning habitat for most Centracrchid species within the lake. Adding trees along the shoreline will make this fish habitat even better as woody habitat in the water provides cover and feeding areas for a diversity of fish species, and nearly all fish species use woody habitat for at least one portion of their life cycle when available (WI DNR Fisheries Management Bureau 2013). Additionally, woody habitat provides nesting and sunning areas for birds, turtles, and other animals (WI DNR Fisheries Management Bureau 2013).

Literature Cited

Aday, D. D., D. H. Wahl, and D. P. Philipp. 2003. Assessing population-specific and environmental influences on bluegill life histories: a common garden approach. Ecology 84:3370-3375.

Aday, D. D., D. P. Philipp, and D. H. Wahl. 2006. Sex-specific life history patterns in bluegill (Lepomis macrochirus): interacting mechanisms influence individual body size. Oecologia 147:31-38.

Allen, M. S., and L. E. Miranda. 1998. An age-structured model for erratic crappie fisheries. Ecological Modeling 107:289-303.

Anderson, R. O., and R. M. Neumann. 1996. Length, weight, and associated structural indices. Pages 447-482 in B. R. Murphy and D. W. Willis, editors. Fisheries Techniques, 2nd edition, American Fisheries Society, Bethesda, Maryland.

Beard, T. D. Jr., and T. E. Essington. 2000. Effects of angling and life history processes on bluegill size structure: insights from an individual-based model. Transactions of the American Fisheries Society 129:561-568.

Becker, G. C. 1983. Fishes of Wisconsin. The University of Wisconsin Press, Madison, WI.

Coble, D. W. 1988. Effects of angling on bluegill populations: management implications. North American Journal of Fisheries Management 8:277-283.

Drake, M. T., J. E. Claussen, D. P. Philipp, and D. L. Pereira. 1997. A comparison of bluegill reproductive strategies and growth among lakes with different fishing intensities. North American Journal of Fisheries Management 17:496-507.

Goedde, L. E., D. W. Coble. 1981. Effects of angling on a previously fished and unfished warmwater fish community in two Wisconsin lakes. Transactions of the American Fisheries Society 110:594-603.

Gross, M. R., and A. M. MacMillan. 1981. Predation and the evolution of colonial nesting in bluegill sunfish (*Lepomis macrochirus*). Behavioral Ecology and Sociobiology 8:163-174.

Guy, C. S., and D. W. Willis. 1995. Population characteristics of black crappies in South Dakota waters: a case for ecosystem specific management. North American Journal of Fisheries Management 15:754-765.

Hooe, M. L. 1991. Crappie biology and management. North American Journal of Fisheries Management 11:483-484.

Hoxmeier, R. J. H., D. D. Aday, and D. H. Wahl. 2009. Examining interpopulation variation in bluegill growth rates and size structure: effects of harvest, maturation, and environmental variables. Transactions of the American Fisheries Society 138:423-432.

IPS Environmental and Analytical Services. 1992. Phase I Lake Management Plan Report, Lake Iola, Waupaca County, Wisconsin. Appleton, Wisconsin.

IPS Environmental and Analytical Services. 1994. Phase II Lake Iola Management Plan Report, Waupaca County, Wisconsin. Appleton, Wisconsin.

Jennings, M. J., J. E. Claussen, and D. P. Philipp. 1997. Effect of population size structure on reproductive investment of male bluegill. North American Journal of Fisheries Management 17:516-524.

Kimmel, B. L., and A. W. Groeger. 1986. Limnological and ecological changes associated with reservoir aging. Pages 103-109 in G. E. Hall and M. J. Van Den Avyle, editors. Reservoir fisheries management: strategies for the 80’s. Reservoir Committee, Southern Division American Fisheries Society, Bethesda, Maryland.

Mittlebach, G. G. 1984. Predation and resource partitioning in two sunfishes (Centrarchidae). Ecology 65:499-513.

Mittlebach, G. G. 1988. Competition among refuging sunfishes and effects of fish diversity on littoral zone invertebrates. Ecology 69:614-623.

Olson, M. H., S. R. Carpenter, P. Cunningham, S. Gafny, B. R. Herwig, N. P. Nibbelink, T. Pellett, C. Storlie, A. S. Trebitz, and K. A. Wilson. 1998. Managing aquatic macrophytes to improve fish growth: a multi-lake experiment. Fisheries 23:6-12.

Osenberg, C. W., G. G. Mittlebach, and P. C. Wainwright. 1992. Two-stage life histories in fish: the interaction between juvenile competition and adult performance. Ecology 73:255-267.

Primising, M. 1985. Status of fish population – Iola Millpond – Waupaca County. Wisconsin Department of Natural Resources – Water Files. Shawano, Wisconsin.

Savino, J. F., and R. A. Stein. 1982. Predator-prey interaction between largemouth bass and bluegills as influenced by simulated, submersed vegetation. Transactions of the American Fisheries Society 111:255-266.

Simonson, T., A. Fayram, J. Hennesey, and T. Treska. 2008. Lakes assessment protocol. Unpublished Guidance Document, Wisconsin Department of Natural Resources, Madison, WI.

Swingle, H. S. 1950. Relationships and dynamics in balanced and unbalanced fish populations. Alabama Polytechnic Institute, Agricultural Experimental Station Bulletin 274, Auburn, Alabama.

Wiley, M. J., R. W. Gordens, S. W. Waite, and T. Powless. 1984. The relationship between aquatic macrophytes and sport fish production in Illinois ponds: a simple model. North American Journal of Fisheries Management 4:111-119.

Wisconsin Department of Conservation. 1960. Iola Millpond Lake Survey Worksheet. Wisconsin Conservation Department, Fish Management Division, Oshkosh, Wisconsin.

WI DNR Fisheries Management Bureau. 2013. Fish Sticks: improving lake habitat with woody structure. Available: http://dnr.wi.gov/topic/fishing/documents/outreach/FishSticksBestPractices.pdf. Accessed 11/14/2017.

Wisconsin Department of Natural Resources. 2017. Iola Lake, South Branch Little Wolf River Watershed (WR08). Available: http://dnr.wi.gov/water/waterDetail.aspx?wbic=278800. Accessed 11/14/2017.

TABLE 1. Species stocked, stocking year, age at stocking, mean length at stocking, and number of each species stocked into Iola Millpond, Waupaca County, Wisconsin between 1967 and 2016.

Species	Year	Age	Mean Length (Inches)	Number Stocked
Bluegill	2016	Large fingerling	0.5	18,925
Largemouth bass	2015	Large fingerling	1.9	11,012
Largemouth bass	2014	Large fingerling	3.2	5,125
Northern pike	2014	Small fingerling	2.7	15,442
Largemouth bass	2013	Large fingerling	2.1	5,148
Northern pike	2013	Small fingerling	4.5	15,451
Bluegill	1970	Adult	Unknown	1,000
Yellow perch	1969	Adult	Unknown	500
Bluegill	1969	Adult	Unknown	1,500
Largemouth bass	1967	Fingerling	Unknown	5,000

TABLE 2. Sample date, distance shocked, distance where only gamefish and where all fish were netted, and electrofishing boat settings for all electrofishing surveys conducted on Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017.

Sample Date	Total Miles Shocked	Miles where only Gamefish were Netted	Miles where All Fish were netted	Electrofishing Boat Settings			
				Volts	Amps	Pulse Rate	Duty Cylce
10/08/2003	3.8	2.8	1.0	175/250	3/4	80	25
09/26/2013	2.5	1.0	1.5	240/260	17/18	50	25
09/29/2014	3.0	0.0	3.0	240	18	50	25
04/30/2015	2.5	0.0	2.5	190/210/212/220	15/16/17	50	25
05/18/2016	1.5	0.0	1.5	220	10	50	25
05/16/2017	1.5	0.0	1.5	240	18	50	25

TABLE 3. Number captured and mean, minimum, and maximum length of each species captured during all electrofishing surveys conducted on Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017.

	2003		2013		2014	
Species	**Number Captured**	**Mean Length (Range)**	**Number Captured**	**Mean Length (Range)**	**Number Captured**	**Mean Length (Range)**
BLACK BULLHEAD	0	-	0	-	0	-
BLACK CRAPPIE	25	4.7 (2.2 - 7.7)	10	4.5 (2.9 - 12.2)	10	5.7 (2.7 - 12.4)
BLUEGILL	153	4.5 (1.7 - 8.4)	32	3.7 (2.5 - 8.6)	81	5.5 (3.2 - 9.3)
BROWN TROUT	0	-	0	-	1	-
COMMON SHINER	0	-	5	-	0	-
GOLDEN SHINER	13	-	5	-	3	-
GREEN SUNFISH X BLUEGILL	0	-	0	-	1	-
GREEN SUNFISH X PUMPKINSEED	0	-	0	-	0	-
LAKE CHUBSUCKER	27	-	20	-	33	-
LARGEMOUTH BASS	83	10.3 (2.4 - 20.0)	35	5.7 (2.6 - 17.9)	51	8.1 (2.6 - 18.2)
NORTHERN PIKE	31	16.1 (6.6 - 22.7)	2	20.4 (18.9 - 21.9)	17	17.0 (12.3 - 29.2)
PUMPKINSEED	15	-	2	5.2 (4.8 - 5.5)	24	5.0 (3.0 - 8.0)
PUMPKINSEED X BLUEGILL	0	-	0	-	0	-
ROCK BASS	2	-	0	-	0	-
WHITE SUCKER	7	-	5	-	20	-
YELLOW BULLHEAD	4	-	0	-	0	-
YELLOW PERCH	10	7.0 (5.3 - 8.7)	2	6.1 (4.3 - 7.8)	0	-

TABLE 3 CONTINUED. Number captured and mean, minimum, and maximum length of each species captured during all electrofishing surveys conducted on Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017.

	2015		2016		2017	
Species	**Number Captured**	**Mean Length (Range)**	**Number Captured**	**Mean Length (Range)**	**Number Captured**	**Mean Length (Range)**
BLACK BULLHEAD	0	-	0	-	3	-
BLACK CRAPPIE	3	8.5 (6.9 - 10.4)	1	9.0 (9.0 - 9.0)	9	7.0 (4.6 - 13.8)
BLUEGILL	89	6.0 (3.9 - 8.7)	156	4.5 (1.9 - 8.5)	209	5.9 (1.6 - 9.4)
BROWN TROUT	0	-	0	-	0	-
COMMON SHINER	0	-	0	-	0	-
GOLDEN SHINER	1	-	6	-	7	-
GREEN SUNFISH X BLUEGILL	0	-	0	-	0	-
GREEN SUNFISH X PUMPKINSEED	0	-	2	-	0	-
LAKE CHUBSUCKER	16	-	24	-	116	-
LARGEMOUTH BASS	50	9.2 (3.6 - 15.4)	38	8.7 (2.9 - 19.4)	41	9.5 (2.8 - 20.2)
NORTHERN PIKE	14	16.2 (13.4 - 26.7)	7	16.4 (14.5 - 18.5)	4	17.3 (12.2 - 21.1)
PUMPKINSEED	60	6.0 (3.9 - 8.1)	99	6.0 (1.6 - 8.8)	35	5.2 (2.3 - 7.6)
PUMPKINSEED X BLUEGILL	2	-	0	-	1	-
ROCK BASS	1	-	1	-	5	-
WHITE SUCKER	7	-	3	-	9	-
YELLOW BULLHEAD	0	-	2	-	15	-
YELLOW PERCH	2	9.6 (8.3 - 10.8)	1	6.0 (6.0 - 6.0)	15	5.9 (4.1 - 7.1)

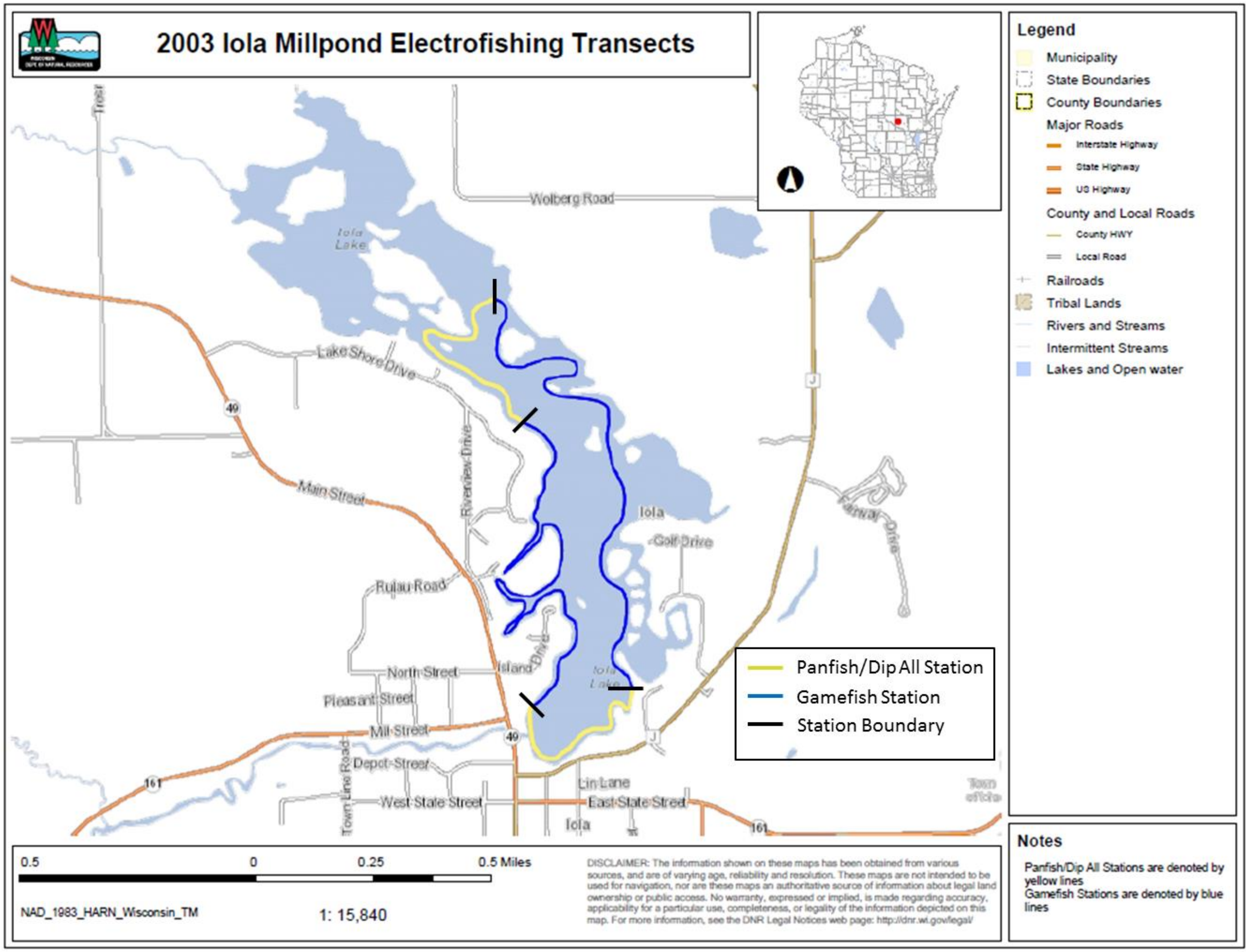

FIGURE 1. Map of 2003 electrofishing station locations in Iola Millpond, Waupaca County, Wisconsin. Blue lines represent gamefish stations and yellow lines represent dip all stations. Black dashes represent station boundaries.

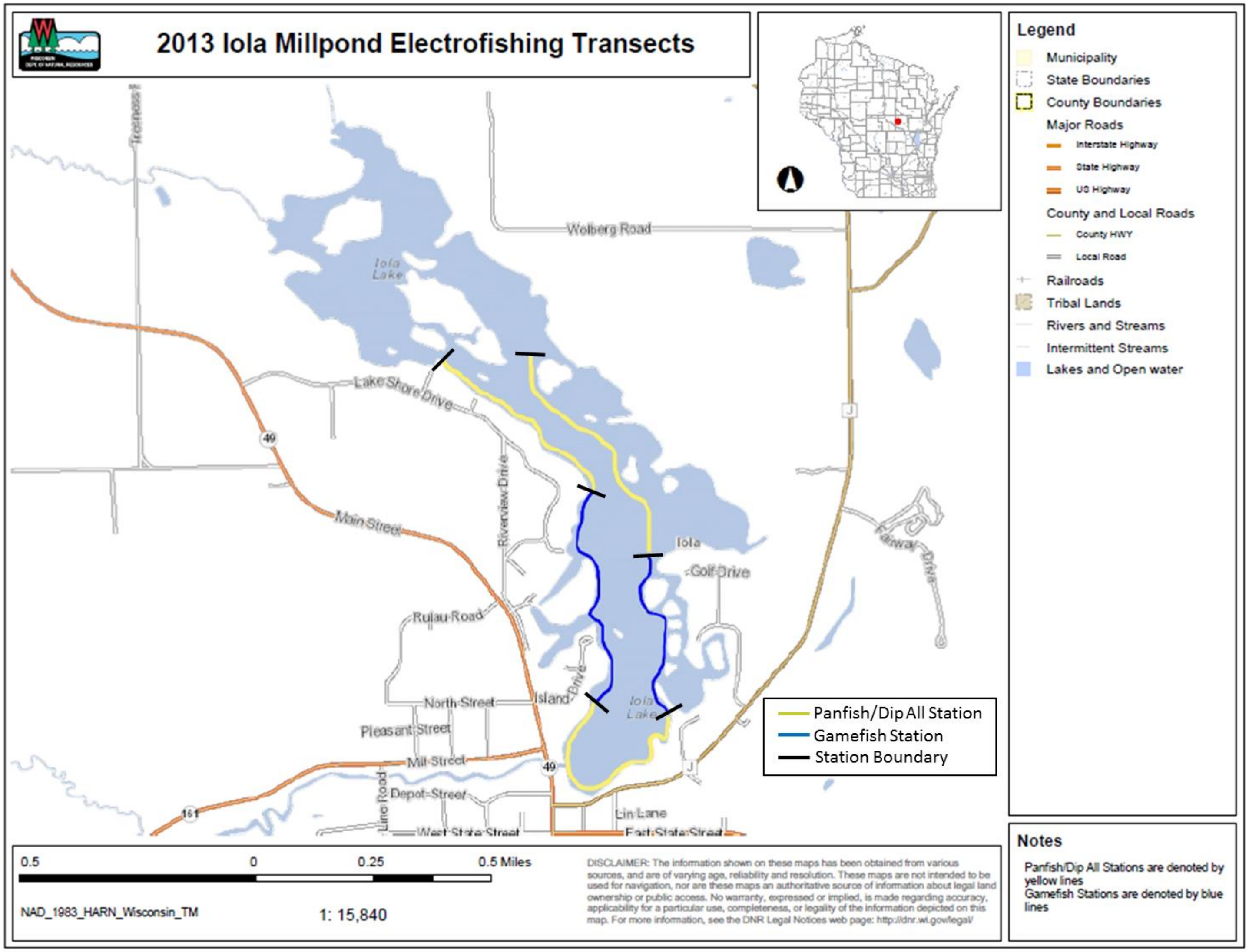

FIGURE 2. Map of 2013 electrofishing station locations in Iola Millpond, Waupaca County, Wisconsin. Blue lines represent gamefish stations and yellow lines represent dip all stations. Black dashes represent station boundaries.

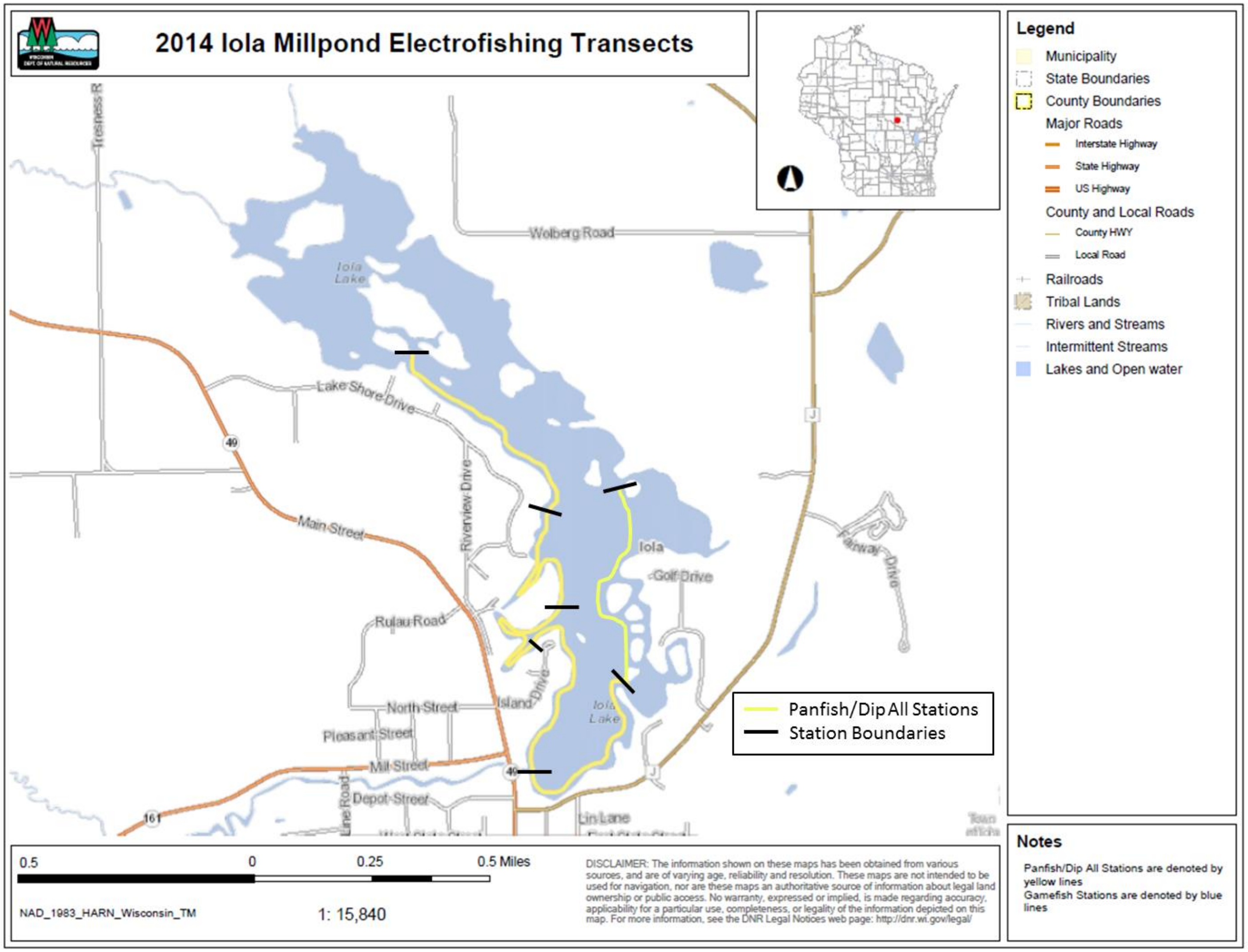

FIGURE 3. Map of 2014 electrofishing station locations in Iola Millpond, Waupaca County, Wisconsin. Yellow lines represent dip all stations. Black dashes represent station boundaries.

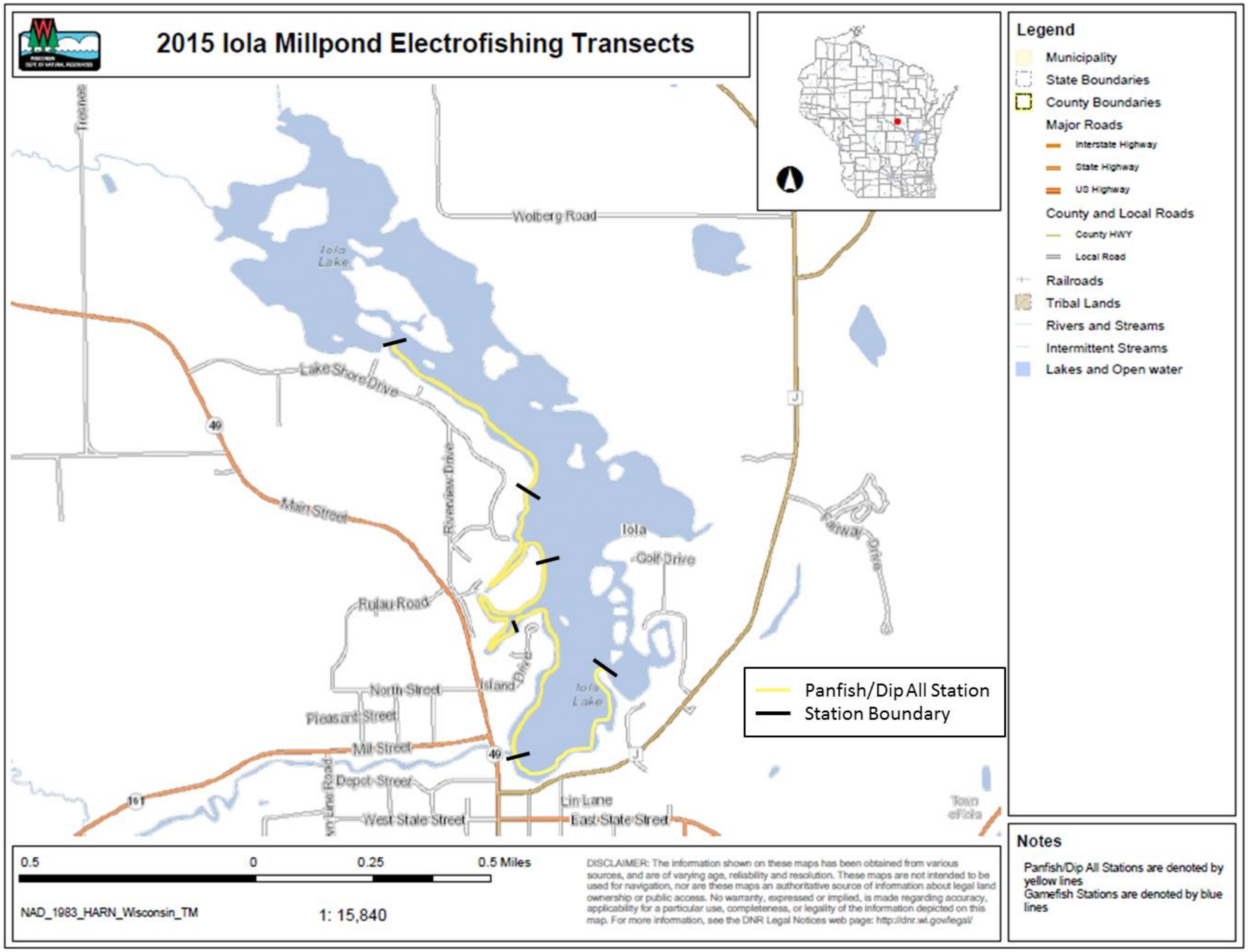

FIGURE 4. Map of 2015 electrofishing station locations in Iola Millpond, Waupaca County, Wisconsin. Yellow lines represent dip all stations. Black dashes represent station boundaries.

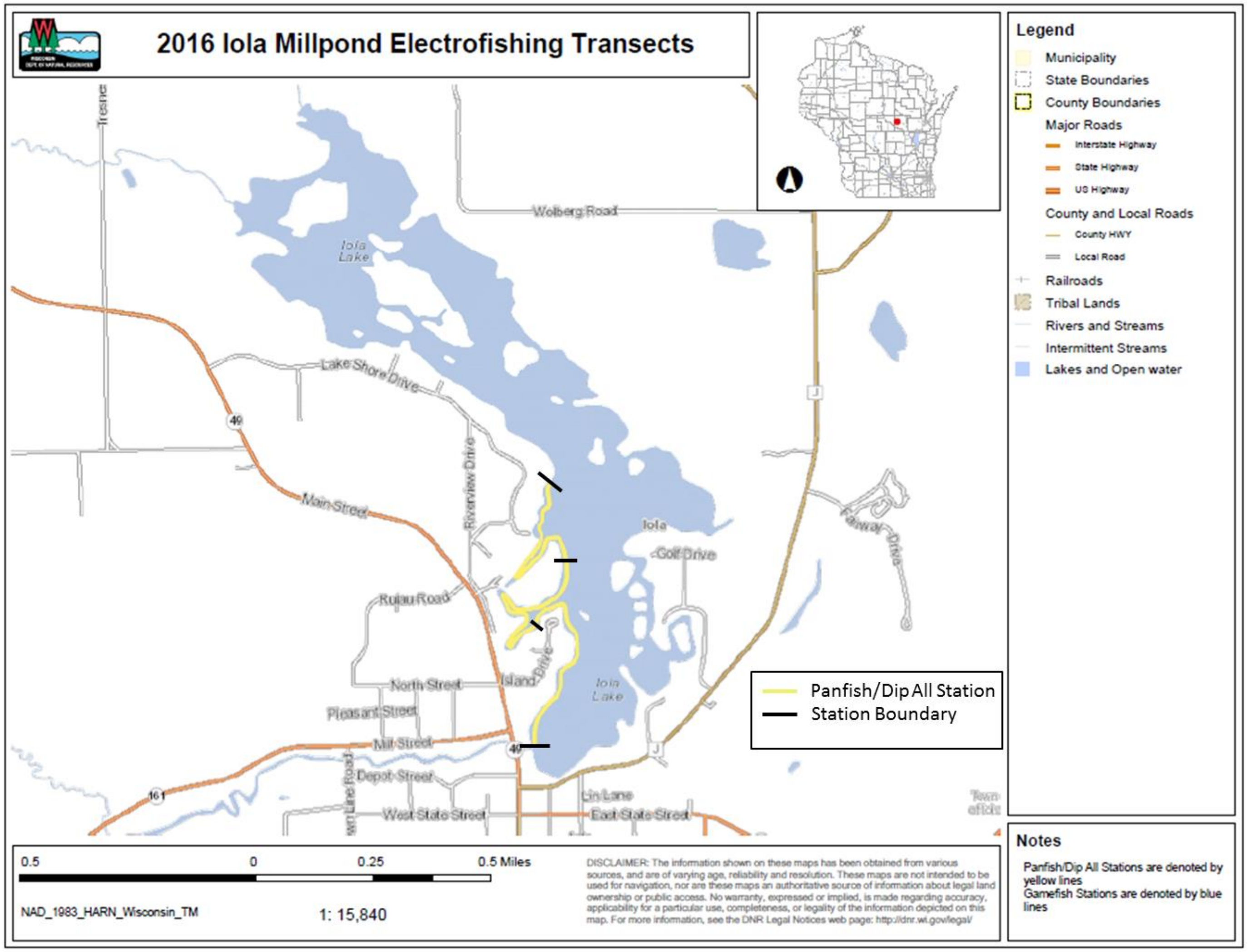

FIGURE 5. Map of 2016 electrofishing station locations in Iola Millpond, Waupaca County, Wisconsin. Yellow lines represent dip all stations. Black dashes represent station boundaries.

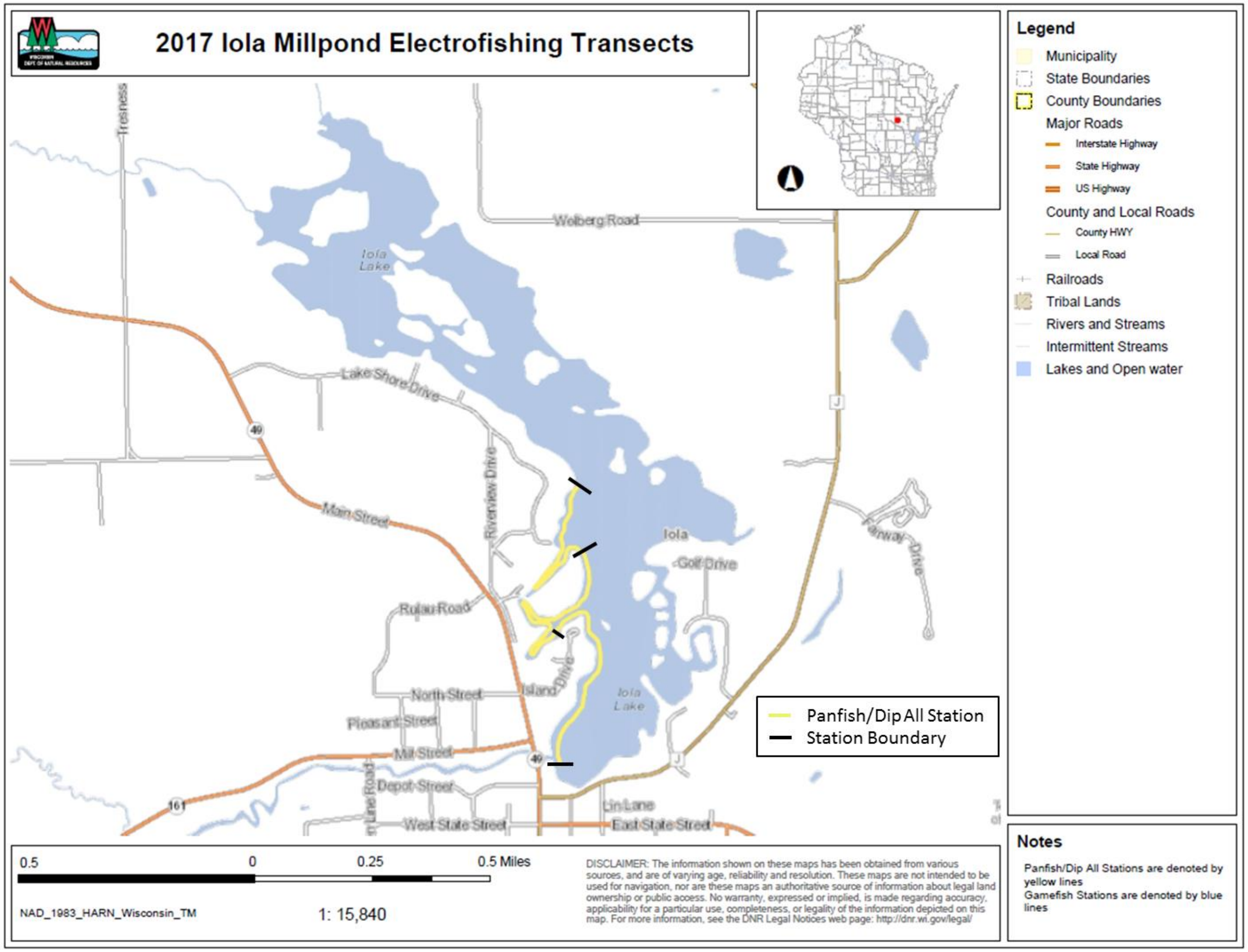

FIGURE 6. Map of 2017 electrofishing station locations in Iola Millpond, Waupaca County, Wisconsin. Yellow lines represent dip all stations. Black dashes represent station boundaries.

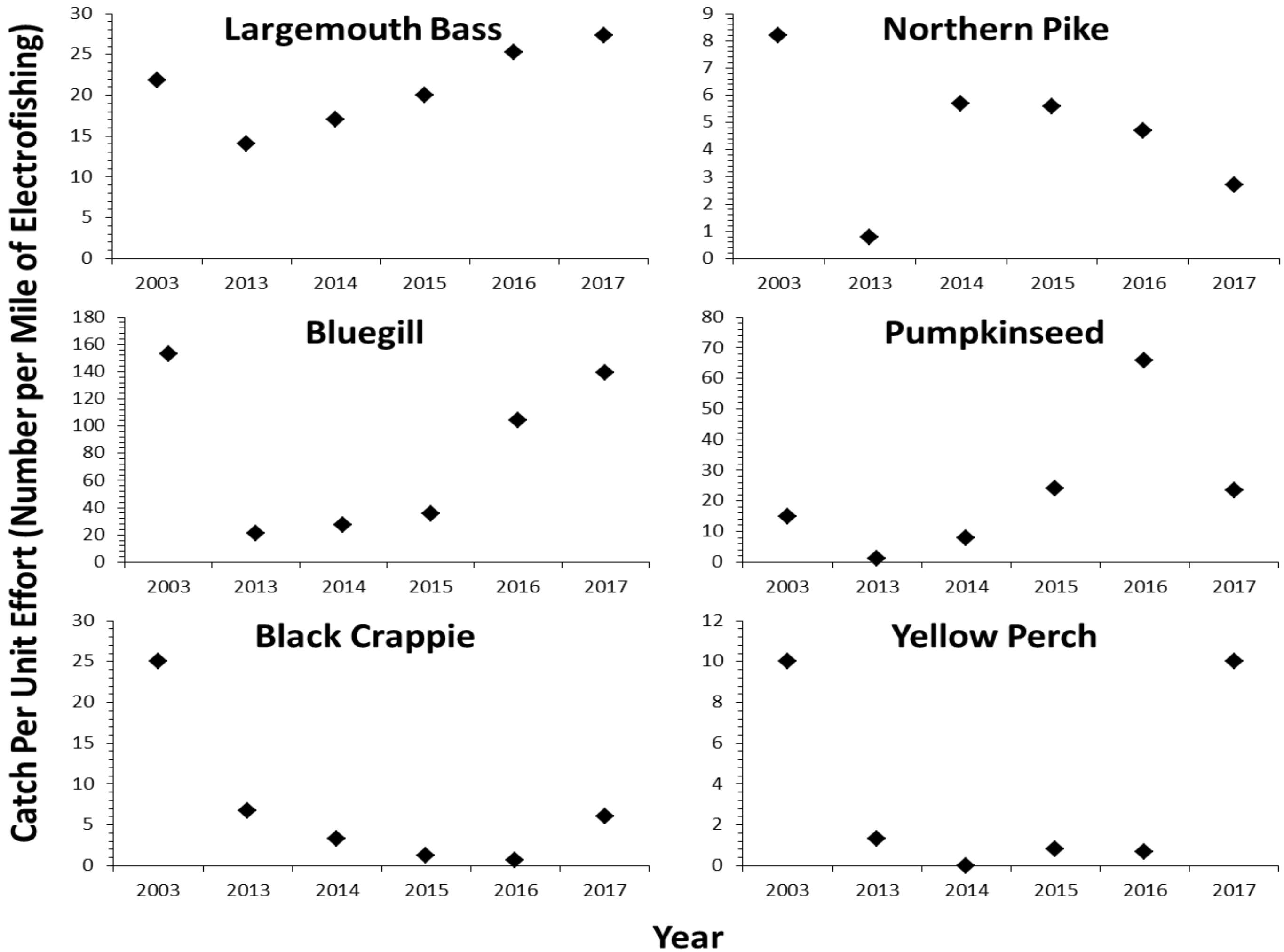

FIGURE 7. Annual changes in largemouth bass, northern pike, bluegill, pumpkinseed, black crappie, and yellow perch catch per unit effort (CPUE) from electrofishing surveys conducted on Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017.

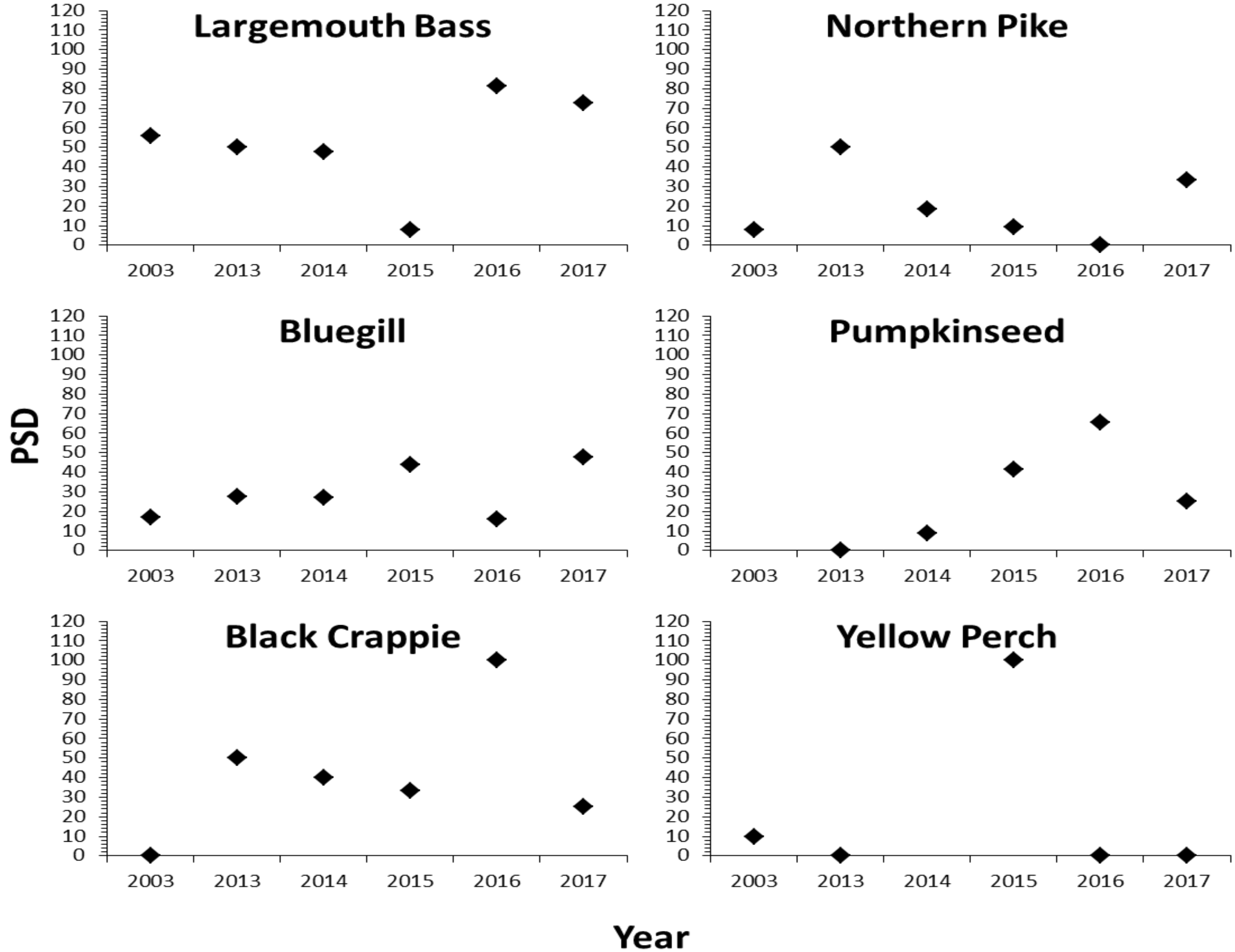

FIGURE 8. Annual changes in largemouth bass, northern pike, bluegill, pumpkinseed, black crappie, and yellow perch proportional stock density (PSD) from electrofishing surveys conducted on Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017.

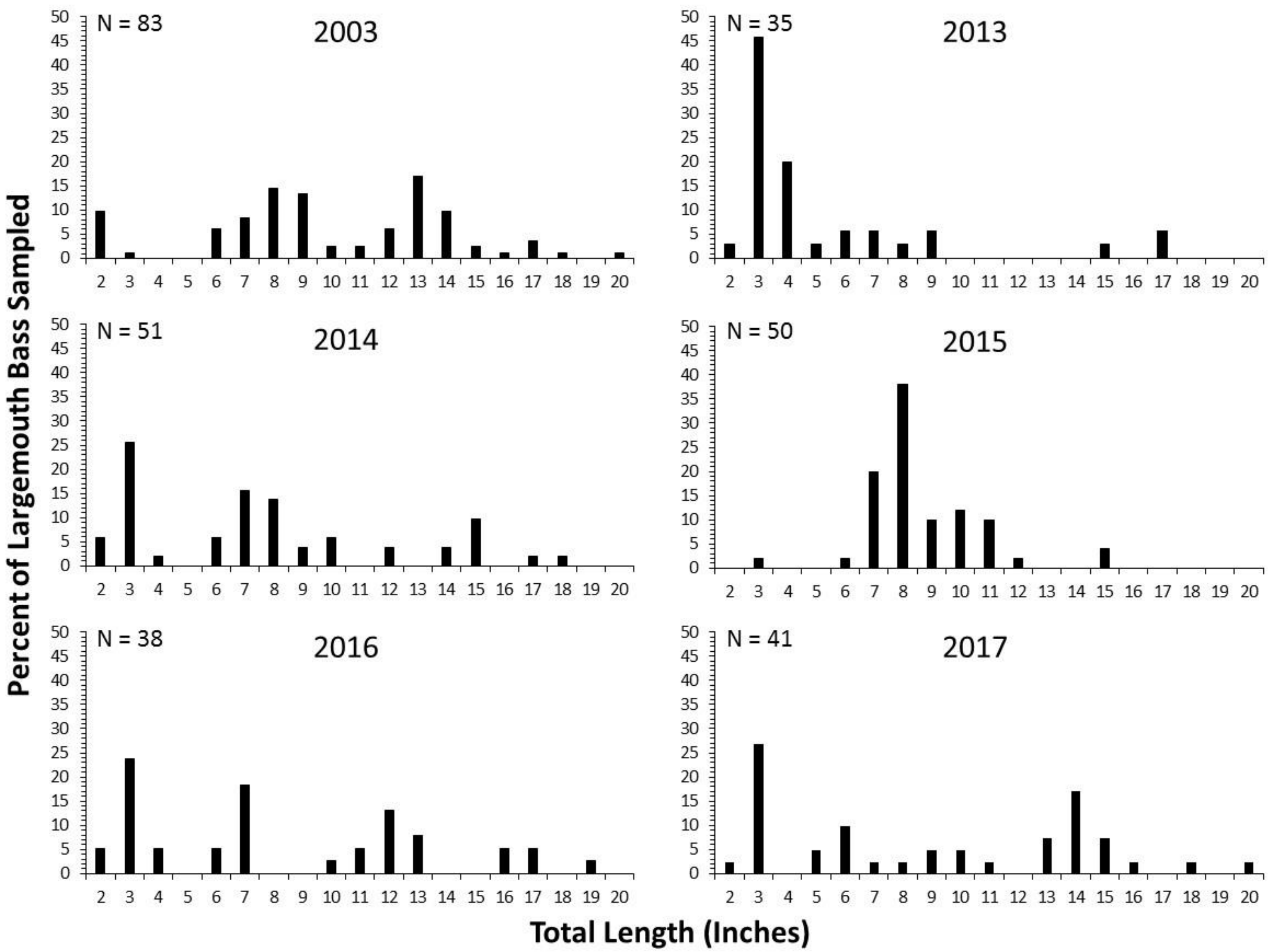

FIGURE 9. Length frequency distributions for largemouth bass sampled during electrofishing surveys of Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017. Total number of largemouth bass sampled in each year are denoted on each graph by the letter N. Length distributions are presented as the percent of the total number sampled for each inch class.

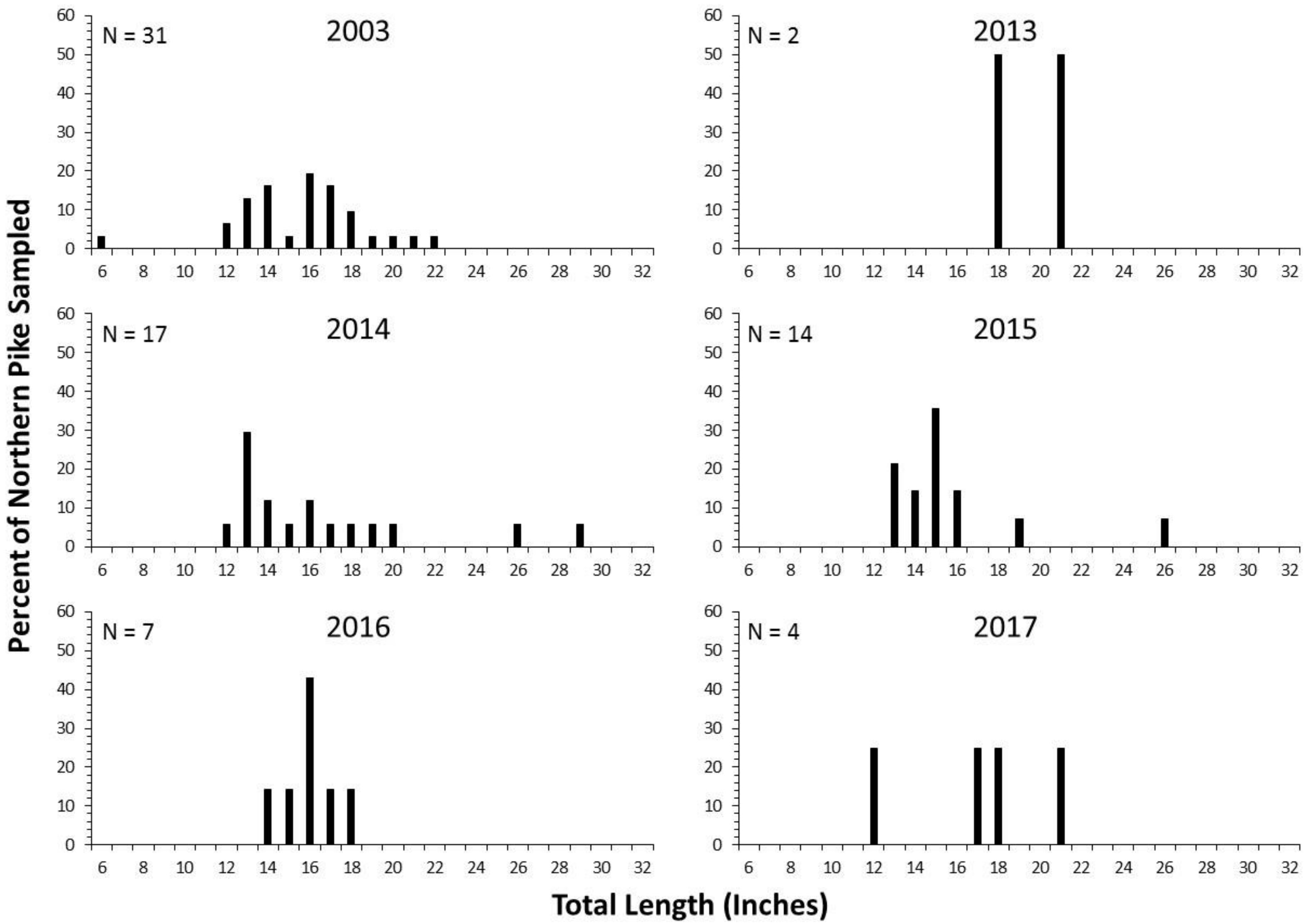

FIGURE 10. Length frequency distributions for northern pike sampled during electrofishing surveys of Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017. Total number of northern pike sampled in each year are denoted on each graph by the letter N. Length distributions are presented as the percent of the total number sampled for each inch class.

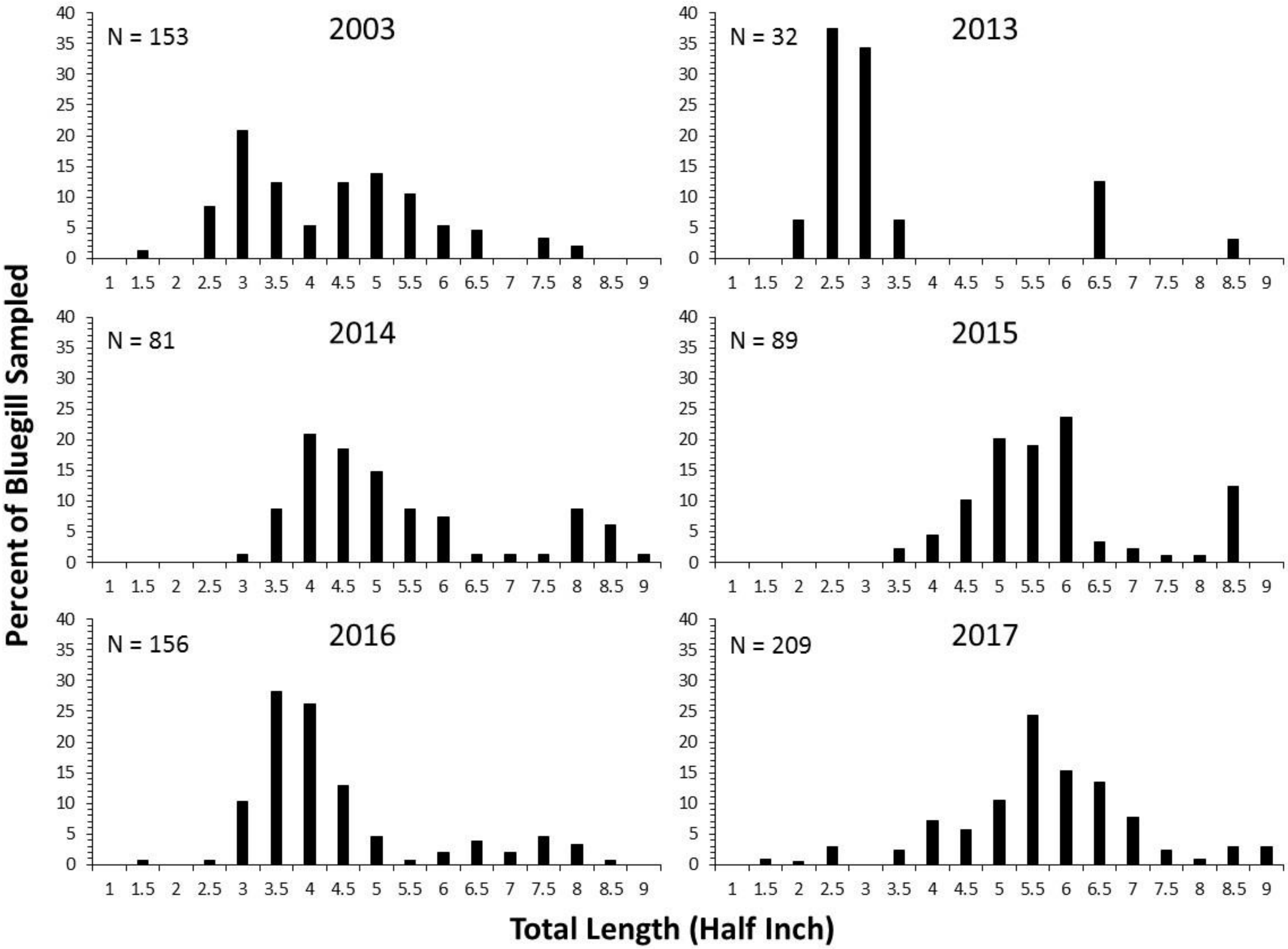

FIGURE 11. Length frequency distributions for bluegill sampled during electrofishing surveys of Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017. Total number of bluegill sampled in each year are denoted on each graph by the letter N. Length distributions are presented as the percent of the total number sampled for each inch class.

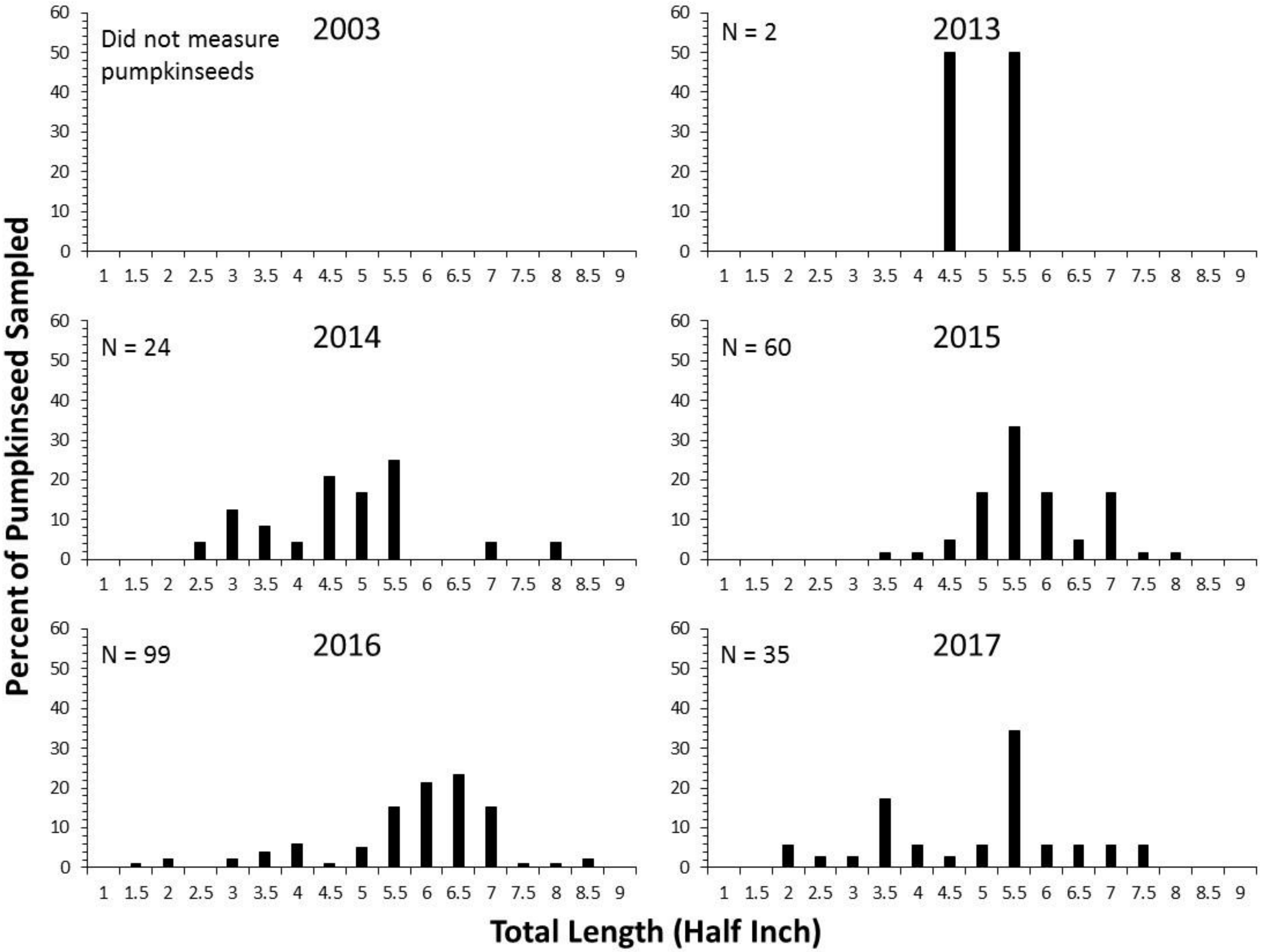

FIGURE 12. Length frequency distributions for pumpkinseed sampled during electrofishing surveys of Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017. Total number of pumpkinseed sampled in each year are denoted on each graph by the letter N. Length distributions are presented as the percent of the total number sampled for each inch class.

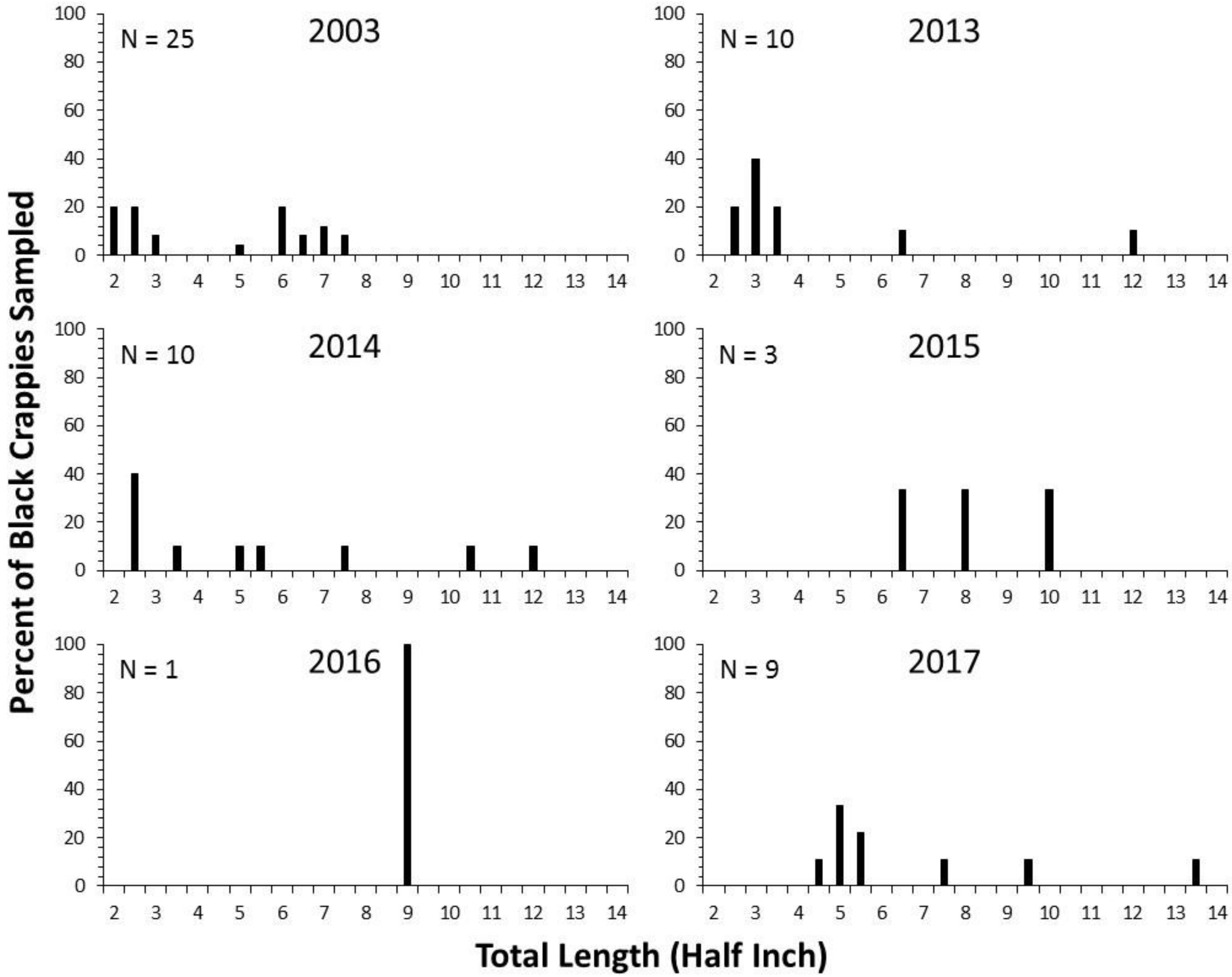

FIGURE 13. Length frequency distributions for black crappie sampled during electrofishing surveys of Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017. Total number of black crappie sampled in each year are denoted on each graph by the letter N. Length distributions are presented as the percent of the total number sampled for each inch class.

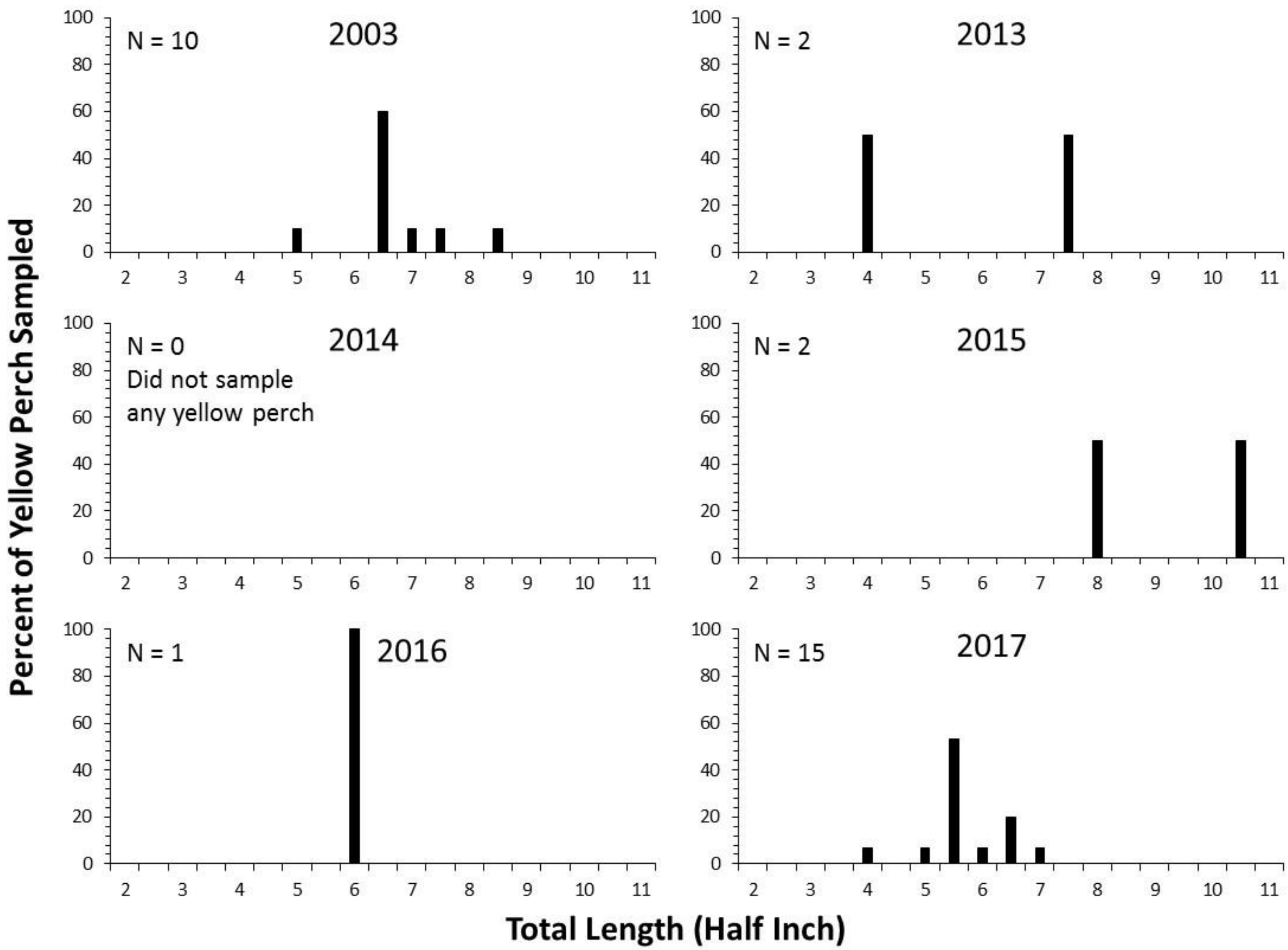

FIGURE 14. Length frequency distributions for yellow perch sampled during electrofishing surveys of Iola Millpond, Waupaca County, Wisconsin between 2003 and 2017. Total number of yellow perch sampled in each year are denoted on each graph by the letter N. Length distributions are presented as the percent of the total number sampled for each inch class.